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Fish Handling System for Blue Whiting

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Fish Handling System for Blue Whiting

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By Olav Meland, Sectional Engineer,
the Department of Fisheries, and
Kåre Lie, Engineer, SSF

During the 1978 season it became evident that it was possible to pump blue whiting, but it was necessary to add water during large portions of the unloading. In order to clarify the conditions surrounding the measurement, straining and handling of the water, a group advising on the unloading of industrial fish commenced experiments whereby blue whiting was pumped during unloading during the 1979 season. The experiment was carried out as a cooperative venture between Giertson & Co., SSF, and the Department of Fisheries.

The results show that blue whiting may be pumped if the ratio fish: water is 3:1. The mean discharge capacity was 68 tons per hour, and the maximum capacity when pumped down was 150-160 tons per hour. The addition of water (water circulation) amounted to 40-50 m³ fresh water an hour, and the water consumption was approximately 10% of the raw material (the discharged quantity of fish).

Strainer Dimensions

Front strainer for
spreading out the fish:

Perforated iron plate

Size..... 1.6 m²

Diameter of the holes..... 10 mm

Clear width ca. 41%

Inclination 30°-35°

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Connecting
strainer:

Perforated iron plate

Size.....1.8 m²

Diameter of the holes 10 mm

Clear width ca. 41%

Strainer belt:

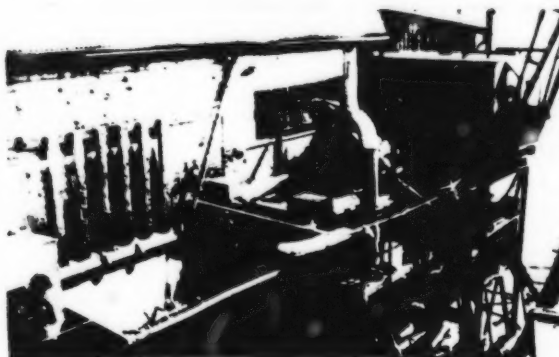
Poly panel plastic belt

Size 2.0x3.8=7.6m²

Size of the holes 2 x 30 mm

Clear width ca. 35%

Velocity 0.33 m/s



The straining system

The Fish Handling System

When planning the fish handling system, the intention was to incorporate the system in the daily operation of the plant, in addition to satisfying the requirements for the experiment. It was therefore important that the system be practical and easy to operate. Due to spatial considerations,

we had to aim at a very compact system. We regarded it as essential to spread the fish in as thin a layer as possible and to procure a strainer belt of the same width as the measuring funnel (2 meters) and approximately four meters long. We placed a combined spreader and front strainer between the pump cylinder and the strainer belt. The front strainer has three longitudinal dividing plates which distribute the stream of fish across the strainer. In the course of the season a connecting strainer was inserted between the front strainer and the belt strainer. The system is shown in Fig. 1.

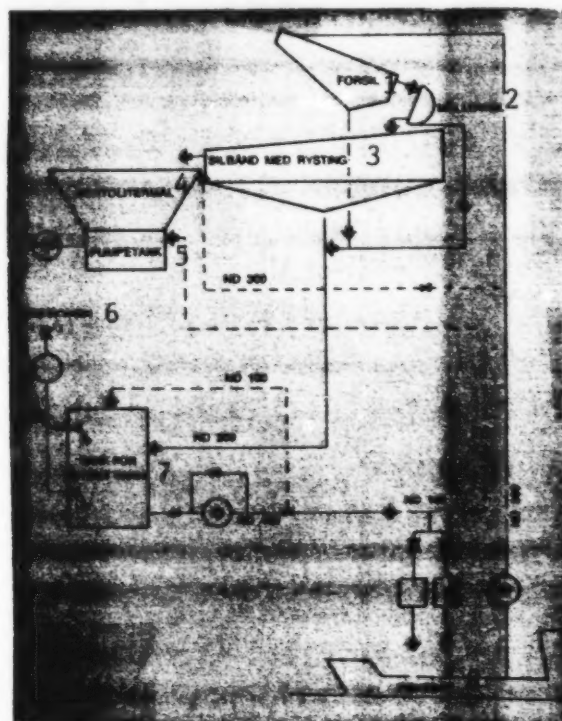


Fig. 1. Fish handling system for blue whiting at Giertsen & Co.

- | | |
|---|--------------------------------------|
| 1. Front strainer | 5. Pump tank |
| 2. Connecting strainer | 6. Fresh water |
| 3. Shaking strainer belt | 7. Tank for water from the strainers |
| 4. Funnel measuring the fish in hectoliters | 8. Fishing boat |

There is a collecting tank measuring 10 m³, for holding the required water. Fresh water is fed into this tank in measured quantities. The water is pumped from the tank with a variable mono-pump (maximum capacity Q 50 m³/h) and subsequently distributed in the hold by means of two 1.5" hoses equipped with spouts which are constructed in such a manner that the water may be turned off.

The collecting tank overflows to a tank at the level of the wharf. This tank is designed to contain the blood-filled water. The water may also be transferred from the collecting tank directly into the plant.

In practice, water is added at the same time as the pump starts pumping the raw material. The fish material is either pumped up to the strainer section, or directly to the measuring funnel if no water is added. The raw material is spread across the front strainer and turned as it glides from the front strainer to the connecting strainer. The fish fall from the latter strainer onto the belt strainer and are conducted to the measuring funnel. The strained water runs back into the collecting tank. Since some of the water remains on the fish as they enter the plant, the collecting tank is automatically refilled with fresh water.

40-50 m³ Fresh Water Circulating per Hour

Water is added in order to loosen the fish in the hold, and it acts as a lubricant. The best results are obtained when the spout is pushed into a mass of fish letting the water burst out to loosen large quantities of fish. Two men are required in the hold at an early stage of the unloading to perform this operation. During the pumping it might therefore be advantageous to have longer tubes on the hoses so that one does not have to go

down into the hold too soon. The disadvantage is that the hoses easily become too heavy and difficult to handle.

The maximum capacity of the pump is approximately 50 m³ an hour. In practice, the system was operated at virtually full capacity which means that 40 to 50 m³ circulated.

Plate Strainers Effective

The water which was strained from the three strainers was measured, but the accuracy of these measurements are somewhat doubtful. They did show, however, that 70-75 % of the water was strained from the front strainer, 10-15 % from the connecting strainer, and 5-10 % from the strainer belt. With a good flow during unloading, the front strainers strain off most of the water. It is important that the layer of fish be turned over between the front strainer and the connecting strainer. If the straining area is increased, the amount of strained off water will no doubt be increased.

We are not satisfied with the performance of the strainer belt. It strains off too little water, and the fact that the belt shakes has no apparent effect. The effect might be improved, if the size of the holes and the velocity were increased. When the discharge is uneven, especially during the last phases of the unloading, the fish move unevenly and with great speed across the front and connecting strainers. When this happens the fish are also crushed a great deal. This combined with the fact that particularly large quantities of water are used during the last phases of unloading in order to conduct the fish material to the pump, clearly makes conditions during the final stages of unloading worse than when the fish are being pumped down. The situation would be quite different if the boats were equipped with a well in the holds, but it is a well-known fact that few boats are equipped with such a device. In the short run,

improvements must, therefore, be made by improving the straining facilities.

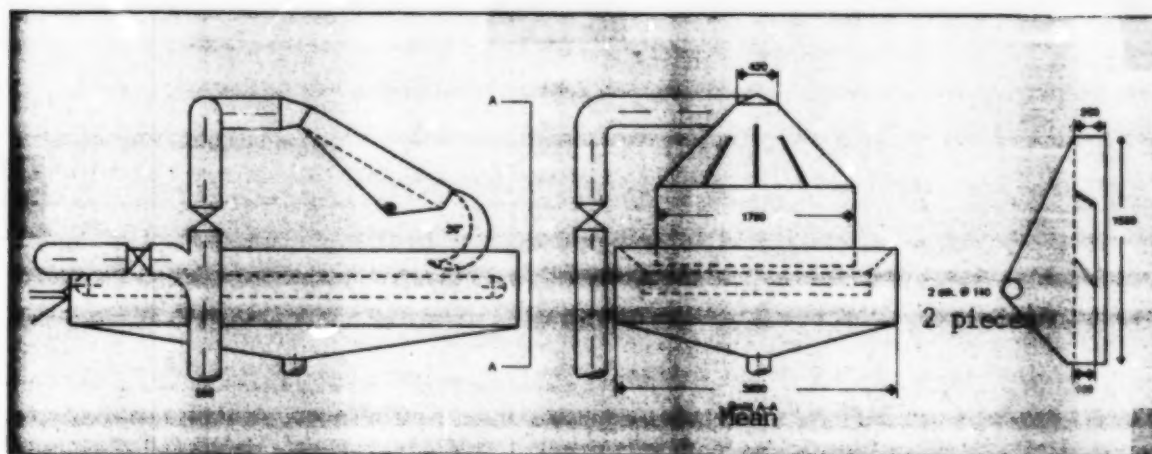
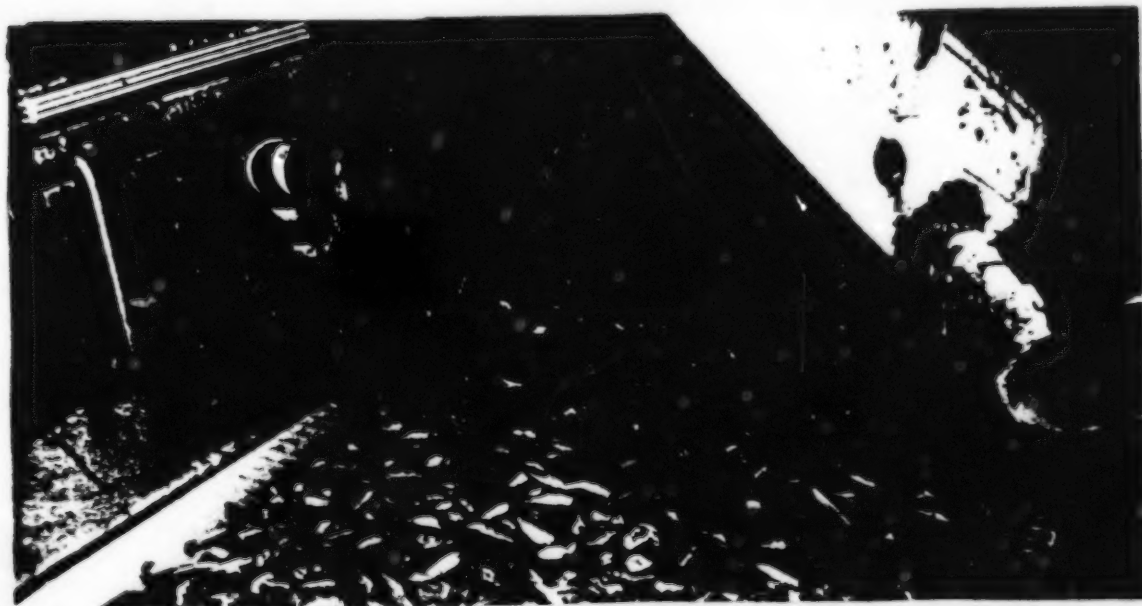


Fig. 2 The straining system - plate strainer, curved connecting strainer, and the strainer belt.



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An even flow of raw material from the plate strainer.

It is Recommendable to Reduce Consumption of Water

The consumption of water, i.e. the quantity of water clinging to the fish material when it enters the plant, has been constant throughout the season at about 10 % of the amount of water added to the fish. This is the case even though the straining process undoubtedly was improved in the course of the season. We believe that this is due to the fact that the pump is being used increasingly also during the final stages of unloading. The amount of water clinging to the fish also depends on the amount of dry matter. It turned out that within a short period of time, 15 to 20 minutes from the beginning of the unloading, the content of dry matter increased by 7 to 8 %, mainly suspended dry matter.

Dato 1	Tørrestoff 2 %	Fett 3 %	Salt 4 %	Salt- og fettfritt ts. 5 %
9/4	7.5	1.5	1.3	4.7
10/4	7.3	1.7	2.0	5.0
27/4	8.1	2.2	2.0	5.1
8/5	8.2	1.5	1.5	5.7
Gnitt 6	7.8	1.8	1.8	5.4

Table 1. Analysis of the discharge water.

- | | |
|---------------|------------------------------------|
| 1. Date | 4. Salt |
| 2. Dry matter | 5. Dry matter free of salt and fat |
| 3. Fat | 6. Mean |

It used to be difficult to get blue whiting to glide into the funnel. However, this presented no problem during our experiment. This is probably due to the fact that (1) water clings to the fish and lubricates them, (2) the fish is cut up by the pumping activity, and (3) the strainer belt feeds the fish evenly into the funnel. The question has arisen whether the use of water influences the quantity measurements. We looked at the ratio between the input and the output quantities in 1978 and this year in the experimental plant as compared to other plants. In our estimation there is no reason to assume that the additional water affects the measurements. The additional water during unloading does result, however, in the washing out of the dry matter in the fish. Approximately 3-5 % of the dry matter may be found in the discharge water. It goes without saying that the water left in the tank when the boat has been unloaded must be attended to.

The more dry matter there is in the hold, the more difficult it is to strain off the water. In order to reduce the amount of water getting into the plant, we tried to clean the discharge water. This was carried out by means of the factory's Roto-strainer (slit opening 0.25 and 0.5 mm). However, it did not yield the desired results. In the future we will try again to use hydro cyclones and decanters. It is hardly feasible to procure the latter just for cleaning the water. But if the plant has a large decanter capacity, it might be useful to take advantage of it, if indeed testing proves that it is successful.

Unloading Capacity Doubled

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The speed of unloading depends on several factors, such as the shape of the hold, properties of the fish, amount of drainage, efficiency of the discharge pump, work input, etc.

When introducing new equipment, it takes time to learn to use it in the most effective manner. We feel that the quite considerable increase in the unloading capacity in the course of the season may be explained in this way (Fig. 3).

After the unloading capacity had stabilized, the mean capacity was 680 hecto_liters [68 tons] an hour. This is twice as much as earlier output when grab cranes were used (78).

When pumping the fish down, the measured capacity was 1500-1600 hecto-liters an hour. In addition, 40-50 m³ of water circulated per hour. This means that the discharge pump was working at full capacity. Table 2 shows the mean discharge capacity throughout the season.

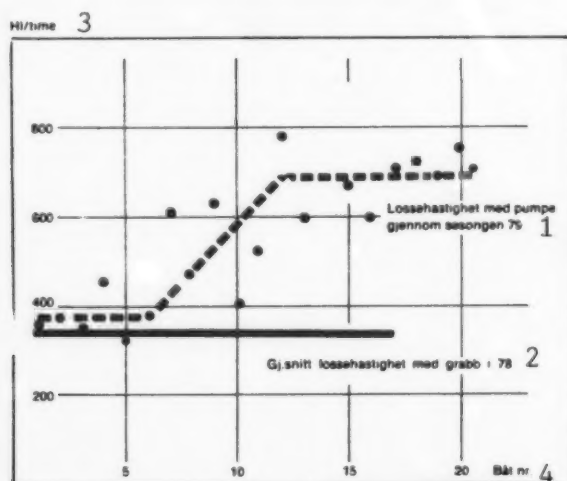


Fig. 3. Discharge capacity throughout the season - blue whiting

1. Discharge capacity when using a pump throughout the 1979 season
2. Mean discharge capacity when using grab crane in 1978
3. Hecto_liters per hour
4. Boat No.

Periode 1	Antall båter 2	Gj.snitt lossekapasitet HI/time ³		
		maks. ⁴	min. ⁵	snitt ⁶
9-23/4	6	456	327	369
24/4-8/5	5	624	401	522
10-29/5	9	773	591	684

Table 2 Discharge capacity - blue whiting

- | | |
|--|------------|
| 1. Period | 4. Maximum |
| 2. Number of boats | 5. Minimum |
| 3. Mean discharge capacity in
hecto_liters per hour | 6. Mean |

Wells in the Holds Render Grab Crane Superfluous

In the course of the season, more and more of the blue whiting loads were unloaded by using pumps, and the quantity unloaded by means of a grab crane was very low. In a number of cases, the holds were completely emptied with the pump. Out of the remaining 50,000 hecto_liters, 181 hecto_liters (0.3 %) were emptied with a grab crane. It appears that the grab crane would be superfluous if there were a well in the hold. Previously, we evaluated and tested additional equipment for the pump for the purpose of eliminating the grab crane. However, the results have been negative. We therefore draw the conclusion that a transition to using the pump when unloading must include changes in the shape of the hold's bottom (sloping to a well). As indicated above, this would have a great advantage, also with regard to grinding/straining.

The Costs of Unloading May Be Reduced

The increased discharge capacity will result in savings of 25-30 %.

In our example (see Table of Costs below) with an 8000 hecto_liter boat, the savings will amount to Norwegian Crowns 0.52 per hecto_liter. The use of water during unloading will increase the costs of evaporation. Depending on the plant's capacity to carry out evaporation, the costs will be in the neighbourhood of Norwegian Crowns 0.19-0.37 per hecto_liter. Altogether, the plant's costs will decrease by Norwegian Crowns 0.15 - 0.33 per hecto-liter if pumps are used instead of grab cranes when unloading blue whiting.

Table of Discharge Costs

Boat: 8,000 hL; unloading commences at 7:00 am; crew of 8 men

Mean discharge capacity:

Grab crane: 330 hL/h in total of 25.5 hours of unloading

Pump: 684 hL/h in total of 12 hours of unloading

Salaries: Basic hourly wages, overtime, additional piece rate, in addition to holiday pay and employer's taxes

Total labor costs:

When using grab crane: Norw. Cr. 1.76 per hecto_liter

When using pump Norw. Cr. 1.24 per hecto_liter

Costs reduced by Norw. Cr. 0.52 per hecto_liter

Evaporation Costs:

Price of oil Norw. Cr. 0.70/kg. Steam kettle 15 kg steam/kg oil.

Three-step evaporator: 0.4 kg steam/kg water evaporated

Dryer 1.2 kg steam/kg water evaporated

It is necessary to evaporate 10 kg water per hecto_liter.

If the evaporation capacity is sufficient,

the cost will be Norw. Cr. 0.19/hL

If 50% of the water is taken in the dryer

or the evaporator respectively, the

costs will be Norw. Cr. 0.37/hL

Total savings when using pumps instead of

grab crane Norw. Cr. 0.33 or 0.15/hL

respectively, depending on the evaporation costs.

In the above calculations, we have not considered the possibility of 16
reducing the number of men required for unloading by means of a discharge
pump, and the resulting savings. The costs of investing in such a discharge
system have not been calculated either as they will depend on the existing
equipment and potential of the plant concerned.

Reduction of Number of Men Required

The same number of men (8) were employed during this blue whiting
season as previously when grab cranes were used: 1 crane operator, 1 measurer,
1 man at the hatch, and 4 men in the hold. The crane operator and the man at
the hatch may be the same person if the crane is operated by remote control.
If the various pumps are turned on and off by remote control, there would
be little reason to have a man on the quay.

During the discharge pumping, there were only two men in the hold at
the same time, even during the final stages of unloading. However, these two
men are active during the entire time of unloading. They would possibly

need to be relieved and to have additional breaks besides the regular ones. Furthermore, there is a good deal of work involved in pulling the hoses on deck. Nevertheless, we are of the opinion that the four men could be reduced by one, perhaps two men, if the work were rotated properly. The discharge crew would then consist of the following: 1 crane operator/hatch man, 1 measurer (automatic measuring?), 1 quay-man for pulling the hoses, etc., 2 or 3 men in the hold. When using a crane with remote control, it therefore ought to be possible to reduce the unloading crew to five or six men.

Experiment of Unloading of Blue Whiting by Means of Pumps and with Addition of Water Successful

- * Blue whiting well-suited for being unloaded with pump, when the ratio fish/water is 3:1.
- * Mean discharge capacity 680 hecto_liters an hour.
- * Discharge capacity when pumping down 1500-1600 hecto_liters an hour.
- * Water circulation 40-50 m³ fresh water per hour.
- * Water consumption approximately 10% of measured quantity of raw material.
- * Front strainer and connecting strainer work well. They strain off approximately 90% of the water.
- * Dry matter in the circulating water approximately 8%.
- * Quantity unloaded with grab crane during final stages of unloading less than 1%.
- * Acceptable in practice to unload certain holds with a pump (without a well or suction hose).

- * If there were a well in the hold, the grab crane would become superfluous.
- * The consumption of water did not affect the quantity measured.
- * Cleaning of the circulating water with strainer (Roto-strainer) was unsuccessful.
- * Any increased evaporation costs are offset by reduced costs of wages.
- * Possibility exists of reducing the number of men in the crew by two to three men (at present the crew consists of eight men).

Is This Discharge System to Be Recommended?

With respect to the addition of water to the boat, we are of the opinion that the arrangement, equipment, and dimensions are satisfactory.

As far as the straining is concerned, we believe it is desirable to spread the raw material across the strainers. The plate strainers surpassed all expectations and can therefore be recommended. If there were more space, especially in terms of height, one should increase the size of these strainers and take care that the layer of fish is turned over several times.

We cannot recommend the straining belts as they are now. The holes are too small and the speed is too low in the bottom layer. It should also be simpler and cheaper. We do not know how large the holes can be without incurring a problem of clogging.

The problem of cleaning the circulating water remains to be solved.

We wish to thank the management and workers at Giertsen & Co. Ltd. for their interest and cooperation during the experiments.